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SHORT COMMUNICATION

Orthopterans (Insecta: Orthoptera) of conservation value in the Eurasian Eagle Owl *Bubo bubo* food in Bulgaria

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Abstract

Three species of Bush-crickets (Orthoptera) of conservation value or poorly known were found in the Eurasian Eagle Owl food in southeastern Bulgaria. Their localities are new country records and two of them cover Natura 2000 SCI zones. The repeated predation on *Bradyporus macrogaster* in UTM square MG99 confirms the potential of this area for a new Natura 2000 site.

Keywords

Bush-cricket, Tettigoniidae, pellet analysis, Natura 2000

Introduction

The Balkan Peninsula has the highest diversity of Orthopterans (grasshoppers, crickets and bush-crickets) in Europe and is one of the most biologically diverse areas in the Palearctic realm. Half of the 1083 species of European Orthoptera occur here (Hochkirch et al. 2016). The largest diversity hotspot in Europe is located in the middle of the Balkans — along the valleys of Vardar and Struma Rivers (compare fig. 6 in Hochkirch et al. 2016). Yet, this reflects also the distribution of threat-

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ened species having a worrying concentration here as well (fig. 8 in Hochkirch et al. 2016).

Studies on the Orthopterans in Bulgaria cover mainly their faunistics and, partly, the taxonomy of species (e.g., Chobanov 2003, 2009; Chobanov and Heller 2010). The distribution, ecological features and conservation status of species occurring in the country are relatively well studied (IUCN Red List of Threatened Species, https://www.iucnredlist.org/), though the only country assessments so far (Golemanski 2015) are mostly based on outdated insufficient data (own unpublished data; also compare Hochkirch et al. 2016). This in combination with the high species diversity in Bulgaria being fifth among European countries (Chobanov 2020), prioritizes the need of accumulating data on the distribution and threatened status of orthopterans in this country.

In recent years studies on diet of birds in Bulgaria revealed the significance of Orthopterans as an important or even staple prey (Miltschev and Tschobanov 2002; Milchev et al. 2004, 2010, 2013). The results not only provided important data on the food spectrum and hunting habitats of predators, but also revealed data on the distribution and abundance of poorly known preyed species. The most striking example was *Pholidoptera brevipes* Ramme, 1939. A species known from a few specimens and localities in SE Bulgaria, extreme NE Greece and NW Turkey before, was found abundant in the food of the White Stork *Ciconia ciconia* with 1668 individuals (5.8%, n = 28947 prey animals) in 54.4% of pellets studied (n = 147 pellets; Milchev et al. 2013). Through cross analysis of the habitat requirements and composition of species in the pellets the data suggested preferred habitats of the species that was later proved to confine to meadows and scrub with high soil humidity all over southeastern Bulgaria (Chobanov 2014).

The Eurasian Eagle Owl *Bubo bubo* is a highly opportunistic top predator but prefers mammals and birds weighing 0.2–1.9 kg. Reducing the supply of appropriately sized prey extends the food niche and the Eagle Owl diet may include more otherwise overlooked species (Mebs and Scherzinger 2008; Penteriani and Delgado 2019). Larger insects have become more common in Eurasian Eagle Owl diets under food stress, and even Mediterranean Wart-biters *Decticus albifrons* were dominant species by prey number in the diet of a successful breeding pair in SE Bulgaria (Milchev and Georgiev 2019). Yet, smaller owls frequently feed on orthopterans, which might represent the main (Šotnár et. al. 2008 and references therein) or significant food source (Chenchouni 2014). Thus, diet analysis of owls may provide new data on invertebrate fauna.

The present study reports new data on the distribution of some poorly known Orthopterans of conservation value found in the Eurasian Eagle Owl diet.

Material and Methods

Food remains from pellets of the Eagle Owl have been collected in 53 breeding sites in SE Bulgaria since 1994 (Milchev and Georgiev 2019). The species identification and the minimum number of individuals for orthopterans relied mainly on mandibles and fragments of head. Orthoptera food remains were considered of a prey origin due to their preservation (not being processed by chewing). Description of the manner of eating of the Eurasian Eagle owl (Frey 1973) suggested the bird removes the digestive tract of larger prey (birds, hedgehogs, etc.) before swallowing it. Smaller prey species that do not chew their food (e.g., frogs; see Glutz von Blotzheim and Bauer 1994) were not common together with invertebrates in our samples (our unpubl. data). The localities were indicated in 10-km squares of the Universal Transverse Mercator (UTM) grid covering most of the respective Eagle Owl's hunting area with 2 km range around the nesting place (Dalbeck et al. 1998; Penteriani and Delgado 2019).

Results and Discussion

Three Orthoptera species of conservation or community importance or poorly known were found in pellets of the Eurasian Eagle Owl. Data on localities of Orthopterans and their conservation status according to the IUCN Red List of Threatened Species (https://www.iucnredlist.org/) and the Red Data Book of Bulgaria (Golemanski 2015) are presented in Table 1. All localities are new country records.

Saga natoliae Serville, 1838 — the Anatolian Predatory Bush-cricket. This remarkable member of the carnivorous subfamily Saginae is the largest bush-cricket in Europe. Its range is confined to the middle latitude belt of the Balkan Peninsula and western Anatolia. Though comparatively widely distributed, its fragmentary occurrence, attractive look for naturalists, and important part of the food chain in its habitat, makes the species of community importance. Hence, it was selected as a model species during a test monitoring study in 2013–2014 (project DIR-5113024-1-48 by the Ministry of Environment and Water of Bulgaria) (http://eea.government.bg/bg/bio/opos/notices/TS_Bezgrabna4ni.pdf). The locality in square MG64 covers the Tundzha Gorge protected area and a Natura 2000 SCI zone. The dominating habitats are xerothermic oak coppices alternating with abandoned agricultural areas, as well as riparian forests. Dry seminatural grasslands and scrub are the main habitat of this species here.

Pholidoptera brevipes Ramme, 1939 — the Short-legged Dark Bush-cricket. The area in square MG66 covers mostly flat terrain along the rivers of Tundzha and Popovska. The dominating humid and semi-humid grassland and riparian forest habitats suggest wide occurrence of the species here.

Table 1. Localities of orthopterans from the Eurasian Eagle Owl *Bubo bubo* diet in SE Bulgaria.

Species	UTM square/ District	Collected on	Number of specimens	Natura2000 zone	IUCN Red List Status Europe/ Bulgaria
Saga natoliae	MG64 Haskovo	27.08.2009	2	SCI BG0000217	LC/-
Pholidoptera brevipes	MG66 Yambol	21.08.2013	1		LC/-
Bradyporus macrogaster	MG99 Yambol/Burgas	29.06.2007	4		EN B2ab(i,ii,iii,iv,v)/ CR A2c; B1ab(i,ii,iv,v)
	MG99	25.08.2007	4		
	MG99	22.08.2019	1		
	MG68 Yambol	20.08.2013	2		
	MG39 Yambol	05.07.2013	1	SCI BG0000401	

Bradyporus macrogaster (Lefebvre, 1831) — the Big-Bellied Glandular Bush-Cricket. This is one of the largest bush-crickets in Europe with a body length of 6–7 cm and an average weight of over 10 grams in adults (Harz 1969 and our own measuremets). Its range covers the lowland and low mountain areas of the eastern Balkan Peninsula and western Anatolia. Its massive body, hard heavy chitin body cover, reduced wings and short legs does not allow it to jump or fly and its movement may be called crawling. The activity of this bush-cricket peaks at late afternoon and early night (Willemse et al. 2018), which probably facilitates to make it more common prey for large night-active owls.

The three new areas cover similar plain to hilly landscapes with a mixture of agricultural land, semi-natural grasslands and xerothermic coppices. The preference towards dry steppe grassland habitats of *B. macrogaster* makes it typical representative of the local fauna, though populations are scarce and fragmented. The higher number of prey specimens in square MG99 may reflect better condition of the population.

The Big-Bellied Glandular Bush-Cricket is the most threatened species among orthopterans in the Eagle Owl diet in SE Bulgaria (Milchev and Georgiev 2019). Main threats of the species are reported to be destruction and change of its habitat by ploughing, overgrazing, construction that directly lead to local disappearance of its populations (Chobanov 2013). The fast decrease of its range was recorded since the 1950s and 1960s (Buresch and Peschev 1958; Péchev 1964) when a massive agricultural land consolidation was executed connected with the large-scale nationalization in Bulgaria in this period. Since that time the species disappeared from its northern (eastern Romania and northeastern Bulgaria) and western range (the region of Niš in eastern Serbia) (Chobanov 2013). As the species is syntopic with its relative *Bradyporus dasypus* (Illiger, 1800), which is numerous also in ag-

ricultural land, it is possible that both species compete directly with *B. dasypus* being more successful in modified habitats (Chobanov 2013). The species attractiveness and requirements for habitats of low disturbance and high vegetation diversity and thus of high conservation value, mostly sub-Mediterranean–sub-continental steppes, makes it not only of high conservation value but also a good indicator for habitat and species community health. Among studied sites, only the locality in MG39 square partially covers a Natura 2000 SCI zone (Table 1). At the same time, the repeated predation on *Bradyporus macrogaster* in square MG99 is further evidence of the potential of this area for a new Natura 2000 site, where a concentration on threatened mammal and bird species included in the Directive 92/43/EEC (Habitats) and the Directive 2009/147/EC (Birds), respectively, has already been reported (Milchev and Georgiev 2012; Milchev and Menzel 2017). Our results support Sergio et al. (2006) in their suggestion that the Eurasian Eagle Owl can be used as an indicator of high biodiversity and for assessing sites for protected areas.

Conclusion

Frequent presence of *Bradyporus macrogaster* in the pellets of *Bubo bubo* in southeastern Bulgaria points to a few interconnected inferences of conservation concern. First of all, pellet remnants of the Eurasian Eagle Owl may provide data of rare and overlooked Orthoptera species and thus raise knowledge on their conservation status and conservation needs. Second, the strong preference of the Big-Bellied Glandular Bush-Cricket towards habitats of high diversity and conservation importance, its large size and easy location via singing males, makes it suitable indicator for habitat quality and species community health.

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